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Docket No. 251002009000

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

#18

In the application of: Ken MAKITA et al. Serial No.: 09/265,669 Filing Date: March 10, 1999 For: PERMANENT MAGNETS AND T-TM-B BASED PERMANENT MAGNETS	Examiner: John P. Sheehan Group Art Unit: 2832

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APPELLANTS' BRIEF

Commissioner for Patents
Washington, D.C. 20231

Sir:

This is a timely appeal from the final rejection of claims 1-4 and 44.

I. REAL PARTY IN INTEREST

The real party in interest is Sumitomo Special Metals Co., Ltd.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences within the meaning of 37 CFR 1.192(c)(2) known to appellants or their undersigned counsel.

III. STATUS OF CLAIMS

Claims 1-4 and 44 (reproduced in the attached Appendix) are pending in this application.

Claims 1-4 and 44 are finally rejected under 35 USC 102(b) as being anticipated by or, in the alternative, under 35 USC 103(a) as being obvious over each of U.S. Patent No. 5,183,630 (Ueda), U.S. Patent No. 5,147,447 (Takeshita), U.S. Patent No. 4,826,546 (Yamamoto '546), or U.S. Patent No. 4,601,875 (Yamamoto '875).

IV. STATUS OF AMENDMENTS

An amendment canceling claim 45 without prejudice or disclaimer has been filed concurrently with this Appeal Brief.

V. SUMMARY OF THE INVENTION

The invention is directed to permanent magnets exhibiting high magnetic performance and, in particular, high coercivity. Such magnets are characterized by a ferromagnetic phase (the major phase) and a grain boundary phase that are matched, i.e., there is alignment of the crystal orientation between the phases. By aligning the crystal orientation of the phases in the vicinity of the interface of the major phase and the grain boundary phase, the magnetocrystalline anisotropy is increased and the inverse magnetic domain near the grain boundary is minimized, thereby resulting in minimal inverse magnetization at the interface. This produces a permanent magnet with increased coercivity.

Moreover, to maximize coercivity, the source of cations in the grain boundary layer is from one, or more, of the following: Be, Mg, Al, Si, P, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Sr, Zr, Nb, Mo, Cd, In, Sn, Ba, Hf, Ta, Ir, Tl and Pb. This list is exclusive of rare earth metals, since rare earth metals typically exhibit low coercivity.

VI. ISSUES PRESENTED FOR REVIEW

(1) Whether the Examiner erred in rejecting claims 1-4 and 44 under 35 USC 102(b) as being anticipated by Ueda '630, Takeshita '447, Yamamoto '546, or Yamamoto '875.

(2) Whether the Examiner erred in rejecting claims 1-4 and 44 under 35 USC 103(a) as being obvious over Ueda '630, Takeshita '447, Yamamoto '546, or Yamamoto '875.

VII. GROUPING OF CLAIMS

Claims stand or fall together as to each rejection.

VIII. ARGUMENT

A. The rejection of claims 1-4 and 44 under 35 USC 102(b) as anticipated by Ueda '630, Takeshita '447, Yamamoto '546, or Yamamoto '875 should be reversed.

1. None of the references shows a grain boundary phase consisting essentially of one or more cations selected from the specified Markush group.

Each of the cited references discloses magnets having grain boundary phases that include rare earth metals. Claims require that the claimed permanent magnets have a grain boundary phase consisting essentially of "one or more cations selected from the group consisting of Be, Mg, Al, Si, P, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Sr, Zr, Nb, Mo, Cd, In, Sn, Ba, Hf, Ta, Ir, Tl and Pb" – a group that does not include any rare earth metals. The Examiner maintains the rejection over the prior art because "rare earths are cations and the claims require that the boundary phase contains cations". For that reason, he alleges that cations of rare earth metals do not affect the basic and novel characteristics of the invention and, therefore, are not excluded by the phrase "consisting essentially of". The Examiner has not asserted that any of the cited references show a grain boundary phase that excludes cations of rare earth metals. In support of the rejection, the Examiner states that "in the absence of a clear indication in the claims or the specification of what the basic and novel charistics [sic] are [sic] "consisiting [sic] essentially of" can be construed as "comprising", MPEP 2111.03." Office Action of August 17, 2001 (Paper No. 12); paragraph 8.

The basic and novel characteristics of the magnets of this invention are 1) "permanent magnets having high magnetic performance, in particular coercivity" (page 32, lines 3-4); and 2) achieving high coercivity through control of the "magnetocrystalline anisotropy in the vicinity of the outermost shell of the magnetic phase". Page 6, lines 12-14. The claims are directed to an embodiment of the invention in which these characteristics are achieved through matching of the ferromagnetic phase and the grain boundary phase, and by using a cation source in the grain

boundary phase that includes elements chosen to produce maximum coercivity. The list does not include rare earth metals, which do not produce the claimed matching of the ferromagnetic phase and the grain boundary phase.

The specification distinguishes between permanent magnets that include rare earth metals and those that do not, at page 32, lines 9-12, where appellants disclose that "a new guideline for developing permanent magnets is provided, while the pre-existing permanent magnets (particularly, R-TM-B based one) can be improved further in coercivity." Further, "novel permanent magnet materials can be found easily, while permanent magnets (particularly R-TM-B one), <u>so far not used practically because of the low coercivity</u>, can be put to practical use, and an optimum composition can be determined easily." Page 32, lines 12-17 (emphasis added). In other words, pre-existing permanent magnets that include rare earth metals suffer from low coercivity.

In the Advisory Action of February 27, 2002 (Paper No. 15), the Examiner continued to misapprehend the scope of the claimed subject matter. The Examiner stated:

> The Examiner maintains the position that the claims do not recite a rare earth free boundary phase. In claims 1 to 4, the term "consisting essentially of" does not preclude the presence of rare earths from the grain boundary. The claims require the presence of a cation in the grain boundary and applicants in their argument have stated that rare earths are cations. If rare earths are cations and the claims require that the boundary phase contain cations how could rare earths be considered as affecting the basic and novel characteristic of the invention and thus be precluded by "consisting essentially of." Further, in the absence of a clear indication in the claims or the specification of what the basic and novel characteristics are "consisting essentially of" can be construed as "comprising," MPEP 2111.03.

With all respect to the Examiner, the language of claims *does* exclude from the grain boundary phase any amounts of rare earths or other components that would *materially* affect the basic and novel characteristics of the invention, by using the "consisting essentially of" transition. Appellants have explained above the properties of the invention that the presence of significant amounts of rare earths in the boundary phase would adversely affect. The Examiner's reading of

claims as not excluding rare earths as cations is not reasonable in light of the specification, since the claims clearly exclude from the grain boundary phase those cations that the specification discloses are disadvantageous, such as rare earths as discussed above. Claims may be read to comprise cations other than those listed, but *not* cations, such as rare earths, in amounts which adversely affect the performance of the claimed magnets.

Accordingly, the Examiner is incorrect in his assertion that the use of rare earth metals as a source of cations in the grain boundary phase would not affect the basic and novel characteristics of the invention of claims . Cations from rare earth metals would affect the basic and novel characteristic of the invention by producing a magnet with lower coercivity. Since none of the cited references shows the feature of a grain boundary phase that does not employ rare earth metals as a cation source, the rejection of claims under 35 USC 102(b) should be reversed.

2. <u>None of the references inherently discloses a grain boundary phase matched with the ferromagnetic phase.</u>

The magnets of claims 1-4 and 44 are not inherently disclosed in the prior art, none of which, admittedly, discloses the claimed matching of the ferromagnetic and grain boundary phases. Anticipation under 35 USC 102(b) requires that "each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co,* 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The Examiner states that "[t]he claims and the reference differ in that the references do not describe the crystal structure in the same terms used in the claims." Office Action of August 17, 2001 (Paper No. 12), paragraph 8. The fact that the Examiner has identified differences between the claimed invention and the disclosures of the cited references by itself demonstrates that the prior art does not anticipate the invention. Moreover, none of the references discloses <u>any</u> recognition whatsoever for the need for, or criticality of, aligned crystal geometry at the interface between

the grain boundary phase and ferromagnetic phase of a permanent magnet, or that such a crystal alignment might improve coercivity.

Since none of the cited references explicitly shows the claimed matching between the grain boundary phase and the ferromagnetic phase, the Examiner alleges that the prior art references inherently disclose magnets exhibiting this claimed feature, because the reference teach similar manufacturing conditions to those of appellants' specification. The Examiner's conclusion, however, is incorrect – magnets made in accordance with the teachings of the references are not necessarily the magnets of the claimed invention. Under MPEP 2112, the Examiner has the burden to provide a *reasonable* basis in fact or technical reasoning to *reasonably* support the determination that the claimed characteristic necessarily flows from the teachings of the applied prior art. The Examiner has not met this burden.

To establish inherency, the prior art references "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Continental Can Co. v. Monsanto Co.*, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991)(emphasis added). "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Id.* at 1269, 20 USPQ2d at 1749 (quoting *In re Oelrich*, 212 U.S.P.Q. 323, 326 (CCPA 1981)). The Examiner must, therefore, provide a reasoned basis for concluding that the claimed features of the invention are necessarily shown in the prior art and would have been recognized by persons of ordinary skill in the art.

The Examiner states that each of the references inherently discloses magnets according to the appealed claims because the references disclose magnets which "are made by a process which is the same process as appellants' disclosed process, that is, these magnets are made by sintering and cooling at a cooling rate encompassed by appellants' disclosed rate of 10 to 200 °C." Although it is true that each of the references discloses typical manufacturing conditions for permanent magnets, not one of the references teaches a process for making a permanent magnet

that is so similar to any of the examples or teachings of appellants specification that the resulting magnet would necessarily include the claimed crystalline structure of the grain boundary phase and ferromagnetic phase. The Examiner's argument is, in essence, that any sintered magnet cooled at a rate of 10 to 200 °C/minute will exhibit the claimed matching between the grain boundary and ferromagnetic phases.

The disclosure of this application illustrates the incorrectness of the Examiner's approach. The Examiner ignores the illustrative and comparative examples in the specification showing that the cooling rate, after sintering, is not determinative of whether the grain boundary phase is matched with the ferromagnetic phase in the resulting magnet.

Illustrative Example 8 describes the manufacture of a permanent magnet. After sintering the alloy at 1100 °C for two hours, the sintered product is cooled to 800 °C at a rate of 200 °C/minute, then to 300 °C at a rate of 100 °C/minute, and then Ar is introduced and the sintered product is allowed to cool to room temperature to produce a sintered magnet. A sample of the sintered magnet is analyzed and described in Comparative Example 8. The remainder of the sintered magnet is further subjected to heat treatment at 500 °C in a vacuum, for two hours, and allowed to cool to room temperature at a cooling rate of 20 °C/minute.

Table 4 sets forth the measured properties of the sintered magnet that was subjected to heat treatment in comparison to the sintered magnet that was not subjected to heat treatment. The sintered magnet that was subjected to heat treatment shows coercivity superior to the sintered magnet that was not subjected to heat treatment. Moreover, in the heat treated sintered magnet of Example 8 the ferromagnetic phase was found to be matched with the grain boundary phase. In Comparative Example 8, appellants indicate that "no specified relative orientation prevailed" between the grain boundary phase and the ferromagnetic phase. Since the sintered magnets of Example 8 and Comparative Example 8 are both cooled at a rate of 10 to 200 °C/minute after sintering, but did not result in both magnets having its ferromagnetic phase is matched with its grain boundary phase, it cannot reasonably be concluded that simply using a

cooling rate of from 10 to 200 °C, after sintering, will necessarily produce the claimed matching between the grain boundary phase and the ferromagnetic phase.

Further, even if a magnet made in accordance with the teachings of the prior art were found to have had matching between the grain boundary phase and the ferromagnetic phase, the Examiner has not shown that one of ordinary skill in the art would have recognized that the references taught the claimed matching. All of the prior art of record is silent as to the benefit of, or even a reason for, providing crystal alignment at the interface between the phases. There is no evidence, therefore, to support the conclusion that one of ordinary skill in the art would have associated a cooling rate of 10 to 200 °C/minute with matching between the grain boundary phase and ferromagnetic phase.

For these reasons, the Examiner has not provided a reasonable factual basis for finding that any of the prior art references teaches permanent magnets that <u>necessarily</u> must include a grain boundary phase matched with the ferromagnetic phase. Moreover, since the references are completely silent as to improvements in coercivity resulting from alignment of the phases, there is no possibility whatsoever that one of ordinary skill in the art would have recognized such a feature. The rejection of claims 1-4 and 44 under 35 USC 102(b) should, therefore, be reversed.

B. <u>The rejections of claims 1-4 and 44 under 35 USC 103(a) as Obvious over Ueda '630, Takeshita '447, Yamamoto '546, or Yamamoto '875 Should be Reversed.</u>

Claims 1-4 and 44 have been rejected under 35 USC 103(a), as being obvious over Ueda '630, Takeshita '447, Yamamoto '546, or Yamamoto '875. The Examiner's basis for this rejection is that "one of ordinary skill in the art at the time the invention was made would have considered the invention to have been obvious because the compositions of the specific examples taught by the references are encompassed by the instant claims and are made by the same process as appellants claimed magnets".

The Examiner's reasoning fails to consider that despite certain similarities between the appellants' disclosure and the prior art, the prior art does not teach or suggest the claimed matching between the grain boundary phase and the ferromagnetic phase, let alone that such a

feature would improve the coercivity of the resulting magnet. "Obviousness cannot be predicated on what is not known at the time an invention was made, even if the inherency of a certain feature is later established." MPEP 2141.03 (citing, *In re Rijckaert*, 28 USPQ2d 1955 (Fed. Cir. 1993)). Further, the Examiner has not produced any evidence that matching between the phases was known at the time the invention was made, or that matching the phases was known to improve coercivity of a permanent magnet. Because there is no appreciation in the references for the claimed crystal geometry, there cannot be any suggestion found in the references to modify the prior art magnets to include a grain boundary phase that is matched with the ferromagnetic phase. And since there is no evidence that the benefit of matching the grain boundary phase and the ferromagnetic phase was known in the art at the time this invention was made, the claimed crystal geometry would certainly not have been recognized by those of ordinary skill in the art to have been achieved. The rejection of claims 1-4 and 44 should, therefore, be reversed.

CONCLUSION

For the foregoing reasons, appellants respectfully request that the rejections of claims 1-4 and 44 under 35 USC 102(b) and 35 USC 103(a) be reversed.

In the event that the transmittal letter is separated from this document and the Patent and Trademark Office determines that an extension and/or other relief is required, appellants petition for any required relief including extensions of time and authorize the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. 251002009000.

Respectfully submitted,

Dated: July 19, 2002

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APPENDIX OF APPEALED CLAIMS

1. A permanent magnet comprising a ferromagnetic phase and a grain boundary phase consisting essentially of one or more cations selected from the group consisting of Be, Mg, Al, Si, P, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Sr, Zr, Nb, Mn, Cd, In, Sn, Ba, Hf, Ta, Ir, Tl and Pb, wherein the ferromagnetic phase is matched with the grain boundary phase.

2. The permanent magnet as defined in claim 1 wherein atoms are arrayed regularly on both sides of an interface between the ferromagnetic phase and the grain boundary phase.

3. The permanent magnet as defined in claim 1 wherein said grain boundary phase has a crystal type, plane index and azimuthal index matched to said ferromagnetic phase.

4. The permanent magnet as defined in claim 1 wherein a magnetocrystalline anisotropy at a lattice point of said ferromagnetic phase neighboring to an interface with said grain boundary phase is not less than one-half a magnetocrystalline anisotropy at a lattice point interior of said ferromagnetic phase.

44. A permanent magnet as defined in claim 1, wherein said ferromagnetic phase comprises ferromagnetic grains displaying magnetocrystalline anisotropy by means of crystal fields from rare earth elements, and said cations are located in an extending direction of a 4f electron cloud of ions of the rare earth elements of the crystal fields located at an outermost shell of said ferromagnetic grains.